

UDC 595.713(477.8)

A NEW SPECIES OF COLLEMBOLA OF THE GENUS *ARRHOPALITES* (ENTOGNATHA, HEXAPODA) FROM A CAVE IN EASTERN CARPATHIANS

R. S. Vargovich

Ukrainian Speleological Association, Petefi 5–40, Mukachevo, 295400 Ukraine

Accepted 29 July 1998

A New Species of Collembola of the Genus *Arrhopalites* (Entognatha, Hexapoda) from a Cave in Eastern Carpathians. Vargovich R. S. — A new troglobiont species of the genus *Arrhopalites* Börner, 1906 (Collembola, Arrhopalitidae) from Ukrainian (Eastern) Carpathians is described. *Arrhopalites carpathicus* sp. n. belongs to the *pygmaeus* group but differs from other known species by the presence of 7–8 subsegments of Ant. IV and bifurcated, laterally serrated female anal appendages.

Key words: Collembola, *Arrhopalites*, new species, cave, Carpathians, Ukraine.

Новый вид коллембол рода *Arrhopalites* (Entognatha, Hexapoda) из пещеры в Восточных Карпатах. Варгович Р. С. — Описан новый троглобионтный вид рода *Arrhopalites* Börner, 1906 (Collembola, Arrhopalitidae) из Украинских (Восточных) Карпат. *Arrhopalites carpathicus* sp. n. принадлежит к группе видов *pygmaeus*; отличается от других известных видов присутствием 7–8 субсегментов на Ant. IV, раздвоенными и латерально зазубренными анальными придатками самки.

Ключевые слова: Collembola, *Arrhopalites*, новый вид, пещера, Карпаты, Украина.

During speleological investigations in Ukrainian (Eastern) Carpathians the new species of the genus *Arrhopalites* was found in karstic cave Druzhba (depth — 50 m below sea level, distance 750 m). This is the first record of the genus from caves of this region.

The holotype and 20 paratypes are deposited in the collection of the State Museum of Natural History of National Academy of Sciences of Ukraine (Lviv). Some paratypes are present in the author's collection.

Head chaetotaxy is given according to the nomenclature of Christiansen (1966). Chaetotaxy of tibiotarsi, dens and apical part of the third antennal segment is described following Nayrolles (1988, 1990, 1991). Nomenclature of Lawrence developed by Christiansen, Bellinger (1996) for the setae of six abdominal segment is used.

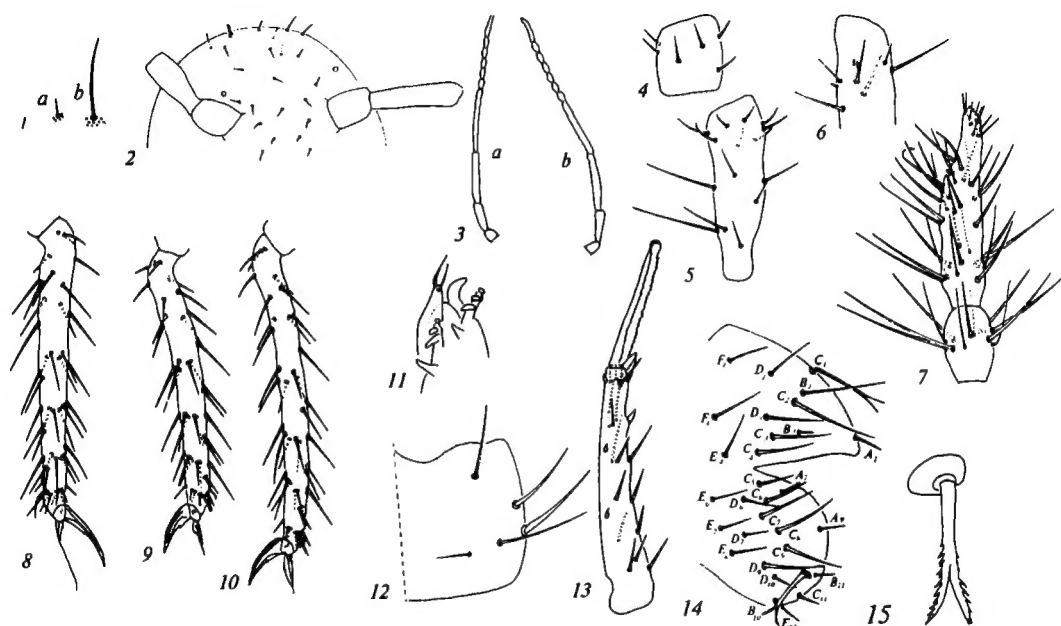
Arrhopalites carpathicus Vargovich, sp. n.

Material. Holotype female, 1.3 mm, slide C-102a — Ukraine, Zakarpatska province, Tyachivsky district, near the village Mala Ugolka, 26.01.1997 (Vargovich), karstic limestone cave Druzhba, Samantha hall, 300 m from the entrance, depth –50 m below sea level, on the water surface of a small pool (1×1 m); 40 paratypes from same cave, in 1990–1998 (Vargovich).

Description. Body 0.9–1.3 mm, without pigmentation, with four pairs of trichobotria; abdomen sparsely covered with short setae in the anterior part and relatively long setae (fig. 1). The longest of those latter approximately equal to length of claws on third pair of legs — in posterior.

Head. Eyes 1+1, unpigmented. No spines. Four setae in M-row are present. IL 2–3 and L-setae somewhat thicker than A and M-setae (fig. 2).

Antennae long, 2.2 times longer than head diagonal. Ant. I : II : III : IV = 1 : 2.4 : 4.1 : 11.5. Ant. I with 6 setae (fig. 4). Ant. II with 15 setae, shorter and slightly curved in distal part of segment (fig. 5). Ant. III without basal swelling. Apical



Figs. 1-15. *Arrhopalites carpathicus*: 1 — body setae: a) on anterior part of great abdomen, b) hind part; 2 — dorsal chaetotaxy of head; 3 — outline of antennae: a) with 7 subsegments on Ant. IV, b) with 8 subsegments on Ant. IV; 4 — Ant. I; 5 — Ant. II; 6 — apical part of Ant. III; 7 — apical part of Ant. IV; 8 — tibiotarsus and pretarsus of leg I, posterior view; 9 — tibiotarsus and pretarsus of leg II, posterior view; 10 — tibiotarsus and pretarsus of leg III, posterior view; 11 — tenaculum; 12 — manubrium, lateral view; 13 — dens and mucro, posterior-interior view; 14 — sixth abdominal segment, lateral view; 15 — female subanal appendage, dorsal view.

Рис. 1-15. *Arrhopalites carpathicus*: 1 — сеты тела: а) на передней части брюшка; б) на задней части брюшка; 2 — дорсальная хетотаксия головы; 3 — антенны: а) с 7 субсегментами на IV сегменте; б) с 8 субсегментами на IV сегменте; 4 — левый членик антенны; 5 — второй членик антенны; 6 — апикальная часть третьего III антенны; 7 — то же IV членика антенны; 8 — тибитарсус и претариус первой пары ног, вид сзади; 9 — то же второй пары ног; 10 — то же третьей пары ног; 11 — тенакулум; 12 — манубриум, вид сбоку; 13 — денс и мукро, вид сзади и изнутри; 14 — шестой сегмент брюшка самки, вид сбоку; 15 — субанальные придатки самки, вид сверху.

organ on Ant. III with two small sense rods, one of which placed little higher than another. Setae *Api* and *Ape* shorter and much thinner than *Ai*, *Ap* and *Ae*; setae *Aai* short and blunt (fig. 6). Ant. IV distinctly subdivided into 7-8 subsegments (fig. 3); with verticillately situated long setae and sensory hairs. Subsegments 2-6 (7) with 7 long setae and 4 sensory hairs each (fig. 7). Apical subsegment with 8 sensory hairs and one strongly curved setae its distal half (fig. 7). In case of 7 subsegments, one pseudo-subsegment present. Basal subsegment of Ant. IV 2.5 times (if 7 subsegments present) or 2.2 times (if 8 subsegments present) as long as apicalene. Ant. III shorter than basal subsegment of Ant. IV if 7 subsegments present (1 : 1.28), and approximately equal to it, if 8 subsegments present (1 : 1.05).

Legs. Tibiotarsal chaetotaxy as in table 1 and fig. 8-10. Claws of I-III pairs of legs with one inner tooth. Claw I (fig. 8) narrower and little shorter than claw II (fig. 9) and claw III (fig. 10), without tunica, with weak inner tooth. Claws II and III with fine inner tooth and tunica dorsally. Empodial appendage I narrower than empodial appendage II and III, with long apical filament, much exceeding claws tip. Empodial appendages of II-III pairs of legs with shorter apical filaments, almost reaching claws tips. All empodial appendages with corner tooth. Empodial appendage III broadest, with its corner tooth smaller than that on empodial appendages I and II.

Ventral tube with two small, curved apical setae.

Tenaculum ramus 3-dentate, with basal club-shaped appendage. Anterior lobe with two apical setae. Tip of posterior lobe exceeding tip of anterior lobe (fig. 11).

Furcula. Manubrium with 5+5 dorsal setae (fig 12). Dens 2 times longer than mucro. Dens chaetotaxy (tabl. 2, fig. 13) typical for *pygmaeus*- group: with five spines dorsally (I e, I i, II pe, III pi, IV pi) and four rows of ventral setae (whorl I — ae, a, ai; whorl II — ae, a; whorl III — a; whorl B—a. =3; 2; 1; 1). Mucro gutter-like, with its both edges densely serrated and tip spoon-like broadened (fig. 13).

Small abdomen (fig. 14) without spines and broadened setae. Two unpaired setae are present: A1 and C1. Setae C1 bifurcated in females and not bifurcated in males. Female subanal appendages (B10) bifurcated, with laterally serrated subequal branches (fig. 15).

Table 1. Tibiotarsal chaetotaxy of *Arrhopalites carpathicus*

Таблица 1. Хетотаксия тибіотарзуса *Arrhopalites carpathicus*

| | P1 | P2 | P3 |
|-------------------------------|-----------------|-----------------|-----------------|
| Primary setae | | | |
| Wanting setae of whorls | 0 | Va | Va |
| Setae K | — | — | — |
| Setae FP | FPae; FPpe; FPe | FPae; FPpe; FPe | FPae; FPpe; FPe |
| Secondary setae | | | |
| Fundamental setae (Vai & Vpi) | + | + | + |
| Setae FS | FSa | FSa | FSa |
| Present setae of interwhorls | — | — | — |
| Variable setae | — | — | — |

Table 2. Dens chaetotaxy of *Arrhopalites carpathicus*

Таблица 2. Хетотаксия денс *Arrhopalites carpathicus*

| Generatrices | e | ae | a | ai | i | pi | p | pe |
|--------------|-----------|----|---|----|-----------|-----------|---|-----------|
| I | + (spine) | + | + | + | + (spine) | — | + | + |
| whorls II | — | + | + | — | — | — | + | + (spine) |
| III | — | — | + | — | — | + (spine) | + | + |
| I–V IV | — | — | — | — | — | + (spine) | + | + |
| V | — | — | — | — | — | — | — | + |
| whorl B | — | — | + | — | — | + | + | + |

Table 3. Differences between *A. carpathicus* and *A. bifidus* Stach, 1945

Таблица 3. Различия между *A. carpathicus* и *A. bifidus* Stach, 1945

| Characters | <i>A. carpathicus</i> | <i>A. bifidus</i> Stach |
|--|-------------------------------|-------------------------|
| Antennae: head (lengths ratio) | 2.14–2.36 | 1.8 |
| Ant. — I : II : III : IV (lengths ratio) | 1 : 2–2.5 : 3.7–4.5 : 10–11.8 | 1 : 2 : 4 : 10 |
| Ant. IV, number of subsegments | 7–8 | 5 |
| Ant. IV — basal subsegment: apical subsegment (lengths relation) | 1.94–2.56 | 1.8 |
| Swelling of Ant. III | — | + (without papilla) |
| Corner tooth of empodial appendages I : II : III | + + + | + + — |
| Empodial apical filament: claw tip I : II : III | > = = | > > > |
| Tenaculum apical setae | 2 | 1 |
| Dens: mucro (lengths relation) | 1.78–2.07 | 1.4–1.6 |
| Eyes | 1+1 unpigmented | 1+1 sometimes pigmented |

Variability

Antennae of females are 2.14–2.2 times, and those of males 2.25–2.36 times long as head diagonal. Number of subsegments of Ant. IV is 7–8, with 1–2 undivided pseudosubsegments. Second subsegment can be not completely separated from the basal one. Apical subsegment of Ant. IV sometimes is partly subdivided into 2 (pseudo)subsegments. Length relations of Ant. I : II : III : IV can vary (tabl. 3). Claw I with weak inner tooth or without tooth. Corner tooth of empodial appendage III is sometimes very small (up to absence).

Discussion

Dens and small abdomen chaetotaxy, other described species indicate its belonging to the *pygmaeus*-group. Female subanal appendages of *A. carpathicus* sp. n. are similar to those of *A. bifidus* Stach, 1945 (from caves of Europe) and *A. chopardi* Cassagnau & Delamare, 1955 (from caves of Libanon). The new species differs from *A. bifidus* by the presence of the corner tooth on empodial appendage III, and two apical setae on tenaculum (tabl. 3), from *A. chopardi* — by the presence of five spines (three in *A. chopardi*) on the dens (Cassagnau, Delamare, 1955), and from the both species — by the number of subsegments of Ant. IV.

Morphological characteristics (unpigmented body and eyes, elongated legs, elongated and well-subsegmentated antennae) the habitat (only deep cave, far away from entrance), indicate belonging *A. carpathicus* sp. n. to the troglobiont species group of the genus.

Acknowledgements

I express my gratitude to Dr. I. J. Kaprus' for his assistance with literature and for his comments on the manuscript.

Cassagnau P., Delamare-Deboutteville C. Mission Henri Coiffait du Liban (1951) 3. Collemboles // Arch. Zool. Exp. et Gen. — 1955. — 91, 4. — P. 365–395.

Christiansen K. The genus *Arrhopalites* in the United States and Canada // Int. J. Speleol. — 1966. — 2. — P. 43–73.

Christiansen K., Bellinger P. Cave *Arrhopalites*: new to science // J. cave Karst studies. — 1996. — 58. — P. 168–180.

Nayrolles P. 1988. Chetotaxie tibiotarsale des Collemboles Symphypleones // Trav. Lab. Ecobiol. Arthr. edaph., Toulouse. — 1988. — 5, fasc. 4. — P. 1–19.

Nayrolles P. Chetotaxie furcale des Collemboles Symphypleones // Trav. Lab. Ecobiol. Arthr. edaph., Toulouse. — 1990. — 6, fasc. 2. — P. 27–50.

Nayrolles P. La chetotaxie antennaire des Collemboles Symphypleones // Trav. Lab. Ecobiol. Arthr. edaph., Toulouse. — 1991. — 6, fasc. 3. — P. 1–94.

Stach J. 1945. The species of the genus *Arrhopalites* occurring in European caves // Acta Mus. Hist. Nat. — Krakow, 1945. — 1. — P. 1–47.